The Dredging Process: Opportunities to Avoid Windows

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Thank you, Tom. Doug asked me to speak about ways, engineering ways, that we can avoid windows. This has been probably one of the most difficult presentations we have put together in a long time.

For one, of course, I work in 50 or 75 minute blocks, and I didn't think you wanted that version. But also I knew having been in a number of these meetings before to some degree, the problem is pretty well known. And Doug has illustrated that well this morning, as well as Jerry.

Now, we really understand the problem. The question is how do we get together? And so I'm going to try to provide some insight and information. And since most workshops go long, I chose to take a shortcut.

The first question is why do we restrict dredging anyway? Ostensibly our interest is to protect the aquatic species and habitat; right? That's what we're all about. Nobody wants to destroy habitat. That's not what we're in the business for. We would all like to see more fish and better habitat.

So we're concerned about suspended sediments that may impair either health or behavior, chemical constituents that might cause some kind of chronic or acute impacts to the biota, as well as sediment deposition that may affect either life stages or habitat. These are the problems that we've already addressed. They've been brought out this morning.

But that's not really why we have windows. The real reason we have windows is that we have a lot of misperception. We have some limited information, weak science. When we add those up, the agencies have chosen to use avoidance as the management tool. If we don't know what the problems are, we're not sure how to get to the answer, the certain solution is we just don't do it. And that's why we get the response from the agencies which we do. We're just not going to let you do it. That's the window idea. We're not sure what the impact is going to be during this time frame, so our choice is to not let you do it.

Now, I think this problem is really not as great as most people perceive. If you start on the impacts side, I suspect even though the science isn't perfect, if you look at what it takes to cause effects to the fish and really change their behavior, and I'm not a biologist, but my understanding as I read that literature is it's fairly substantial. It does occur. It shouldn't be minimized, but it's not something that happens easily. They're very resilient.

And we have to remember dredging is a temporary operation. It's not going on 365 days a year at the same location. It's always moving. It's always a different area.

On the other hand, probably the greatest misperception is with respect to the impacts that dredging causes. And I show one photograph here. It's a fairly typical bucket that we might see, and the visual impact is significant. We all look at that and we say oh, how terrible. Yet when we look at the data, the data shows pretty clearly and pretty consistently that the loss rates or the water quality impacts in almost all cases are far less than most people perceive.

For example, having measured many plumes, I will tell you that in most cases you'll have a very hard time finding a plume more than 300 meters downstream with any instrumentation, in almost all cases. Now, of course, that depends upon the currents and a variety of other factors. But with dispersement and settling, these go away pretty quickly. And you probably won't find a significant plume past a hundred meters or so.

Now, I would imagine if you talked to most people, their perception, like mine before I did this, would be much greater.

In one of the first research projects that we did, we set up stations. I think the farthest station we had was a little over 3,000 feet downstream, and we were concerned that might not be far enough. And you know what we saw: nothing. We wasted many, many samples because there was nothing there.

Yet, a lot of our work is in contaminated sediment. And the perception is that we don't want to dredge this because we're going to stir it all up and move it around. That's the perception; right? And that perception is an error. I think this is a case where we actually have a very practical problem, if we can talk about the sites. And I believe there's a lot of room for us to come together in the middle.

All right. Let's look at some opportunities for reducing windows-related problems. First off, let's talk about how we define the problem. You know as I was trying to put this together, what struck home was how much we are all in agreement with what the concerns are.

We did a small project for Tom back in the fall. And we set up some protocols and ideas about how to deal with windows in New York Harbor. I received the NAS report in February, and they're almost the same. Obviously, the NAS report was much more detailed and much more thorough. The concepts were the same, indicating we all really understand what the problem is.

We need to tie the impacts to the problem. We need to tie space, time, and concentrations with biological impacts and depositions. I hear about deposition a lot. And if you know much about plumes and dredging, you know that depositional effects outside the immediate vicinity of the dredge are almost nonexistent. It certainly may require some site specific studies.

We also need better knowledge. That's been brought out a number of times already today. We do need more resuspension data for a variety of conditions. We have a lot of anecdotal data, but dredging operations operate in many different areas and under many different conditions. Every condition is going to raise new problems, and we need to have better data to defend or at least justify what I think we already know.

We also need to improve our understanding and our modeling capabilities. Doug went over this, so I really won't spend much time. But it is important to be able to produce estimates that are reliable and understandable and believable.

Another alternative is performance criteria. Now, conceptually the idea of performance criteria makes a lot of sense. Where does this come in? It comes into solving windows. If you can work in this time frame within these criteria, then it's okay. Conceptually that makes a lot of sense. You establish what the criteria are. You have to live with them. And if you can, then that's great. It's certainly better than a strict prohibition, but it's very difficult to implement.

And again while we understand a lot about the dredging process, and we understand a lot about the impacts, we know a lot less. And I'll deal with this more in a minute about how to operate and implement performance criteria in a meaningful manner. We're talking about taking many samples, monitoring, trying to change operations, and the turnarounds just are difficult to accomplish. But if you're going to do it, you really need to be capable of compliance monitoring. We need to be able to show that we are successful. That's a big problem itself.

We also need some agreements for flexibility down the road, assuming that we're successful. I think you'll find in most cases we're willing to undertake fairly intense and relatively expensive efforts if we think at the end the situation is going to be improved. If we can show that the dredging operation doesn't have these impacts, we really shouldn't have to do them over and over again.

The real thing that Doug wanted me to talk about today was dredging controls, and the concept is really pretty simple. Can we reduce the source generation by either restricting the operation or modifying the equipment?

And I hear this a lot, that if we could just change the equipment or if we could just operate it correctly, we'd be in great shape. The advantages are pretty obvious. It's easy to implement. You could monitor compliance. It's not like taking water quality samples where you need many of them repetitively. If you can establish operation criteria, you can set them. They're easily measured, they're easily monitored. You can say yes, they actually work.

And there are no direct costs involved. There are many indirect costs. And those have already been brought up today; there are some additional costs that are associated with any type of control. And certainly this is true when you start monkeying with the dredging operation itself.

Let's talk about some examples. With mechanical dredges, probably the most common control is restrictional overflow from the hopper barge. You simply allow them to fill the barge and stop before any spillage occurs. And I would argue that if you're concerned about resuspension, then this is a great place to start because it does have a significant effect, but it is not without cost. The economic load of the barge is far greater than when it was first filled in almost all cases. So, the perception that there's not a cost is clearly incorrect.

In many cases we see bucket selection as another alternative approach. Sometimes effectively, sometimes not. One of the problems we have is that it's sometimes hard to define the type of bucket that you might like to see used. More pragmatically, in a dredging operation it's more difficult to keep a bucket sealed. Ideally we would have buckets that wouldn't leak. The truth is that it's virtually impossible to do in a maintenance dredging operation. The operation itself is aggressive. It's mechanical. And rubber seals and caskets just aren't going to last very long.

So, you're going to get leakage. You also can't entirely seal the bucket, or else it will cause so much resuspension when the bucket hits the bottom. So, you have to have venting. And that venting, of course, allows some spillage as it comes up.

We do know, however, we have enough data to show that there are some advantages to enclosed buckets in terms of where the plume is located. We do know we get less resuspension at the surface, and we get more at the bottom. And there are some advantages to having that down at the bottom because of the transport.

One of the things that's become more popular, in the contaminated sediment arena, but I fear may move forward, is a cycle time. And with a bucket dredge specifically, you must use a cycle time of some minimal amount. The idea being we're trying to restrict an overly aggressive operator from causing undue water quality impacts. It's a great idea. The problem is it's difficult to implement. I was watching a project back last summer where someone had decided to implement a four-minute cycle time.

Now conceptually, that sounds okay because they're really going to have a slow operation, they're going to be careful. The problem was the water was about three feet deep. And so the operator did what any operator would likely do. He took his bucket, he dumped it in the barge, he moved it back over the water, and drank his coffee. He took his bucket, moved it over, came back, drank his coffee. It didn't accomplish the objectives.

And so I guess the message I'm trying to get across is that it's fine to implement these, but you need some science behind it. You need some logic, you need to make sure it's going to accomplish what you want to do, because there is an impact. There is an economic cost, and you really shouldn't be doing it unless you're going to get something for it.

We talk about hoist and drop speed. Again, it is very logical that we don't slam the bucket to the bottom. We don't raise it at some aggressive rate. But we are not far enough at this time, at least from my perspective, to define what is acceptable and what's not. I hope we'll get better, but right now I'm not sure we're able to do that.

In cutterhead dredges, a common criteria that someone might restrict is swing speed. How fast can they actually swing the dredge itself, how fast the cutter itself may rotate as well as the maximum dredging depth. And we have data that clearly show that all these can impact resuspension.

However, if you look at the data more closely, what you find is that those impacts are very minimal, except outside of normal operating conditions. In other words, can you increase your cutter speed to the point that it increases resuspension? The answer is probably yes.

But in most cases under normal conditions, the operator would not be trying to do that anyway because in soft sediments, they really wouldn't need a cutter to turn very fast, and that's when it would have an impact.

The same with swing speed. You can only feed the dredge at a certain rate, the rate which the plume can handle. At that rate, it's probably fine. Now, if you start getting overly aggressive and you feed the plume more sediment than it can accept, sure you're going to have increased losses.

One of the problems, though, is that when you combine these three, and these are probably the three areas that I see most often. We often end up restricting the production of the operation and somewhat arbitrarily extending it. And by doing so, we probably don't reduce resuspension at all or if at all very little. So, actually we’re exacerbating the problem we're trying to solve.

And so I get asked often about developing controls, and I usually tell people that I don't think I know enough to develop these very well. And I think I know more about it than many other people do. And so I worry when I'm on projects and somebody has instigated one of these controls. And I doubt that they're very often based upon real sound science.

There are site controls as well. The concept there is pretty simple. It's to limit transport. We can't limit what happens at the dredging operation, but we limit how far it goes. Primarily here we're talking about silt curtains. And again, they're relatively easy to implement, and you can monitor the compliance. Is it in place, or is it not in place? That's convenient.

Mainly we're talking about silt curtains and screens. Certainly they work and have been shown to work well under appropriate conditions. We do know that it's almost impossible for them to entirely restrict the plume. And in most cases, there will be some flow underneath. But that's not necessarily a bad thing because we will have moved the suspended sediment closer to the bottom which means it will settle more quickly and will shorten the duration of the plume.

But again there are some costs. They are expensive to purchase. They're also expensive to maintain, particularly in the wrong conditions, and they're not effective. So, again a good idea that has some great use if it's done in the right manner, but not in the wrong.

Lastly monitoring. Actually this seems like the real panacea; we'll just monitor everything. I've monitored many dredging operations, and I can tell you it's a very difficult effort. In fact, Neville has written a short protocol on how to go about doing it, and it's expensive. It takes a lot of equipment. It's not a simple operation. You're not going to go out and take three samples and have any measurable or useful compliance information.

So, you have to in the beginning agree that you're going to have some feedback in the decision making process. And you're going to get a data set that's going to improve your knowledge in some manner. And your goal would be that if you can do that, hopefully in the next realm you shouldn't have to go back and have that intense of an effort again. Again, it's one thing to have a one-time or a two-time very intense monitoring effort, but you cannot do this on a continuous basis. Again, I've done it. I promise you that you just cannot possibly do it.

The monitoring certainly needs to be designed to meet the objectives, and again a single point of actual concern. There is some hope of automated monitoring, and I've been working on a system I'm not quite ready to talk about that might help some of this. And the idea would be they'd be able to do an automated monitoring effort that you could watch as you go along. So, that's really all I have. I guess at the end we'll take some questions.